

Improved Rhenium Thrust Chambers for In-Space Propulsion, Phase I

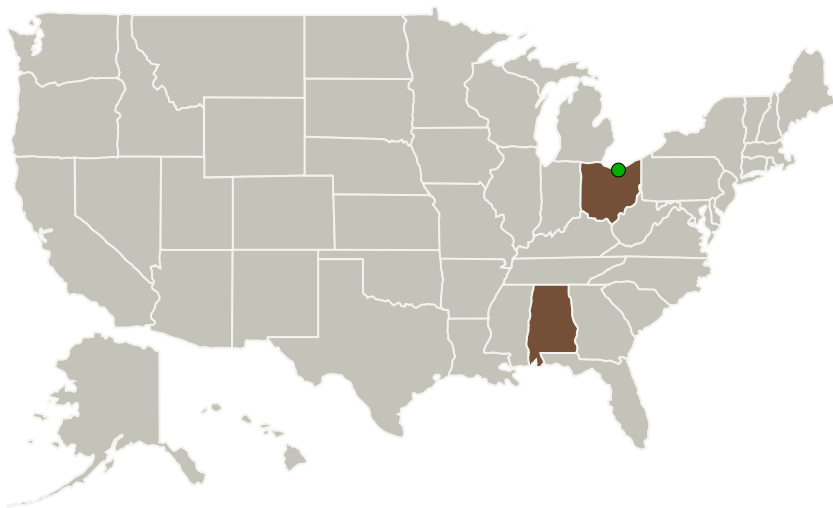
Completed Technology Project (2011 - 2011)



Project Introduction

Radiation-cooled, bipropellant thrust chambers are being considered for the ascent/descent engines and reaction control systems (RCS) for future NASA missions such as Mars Sample Return. Currently, iridium-lined rhenium combustion chambers are the state-of-the-art for in-space engines. NASA's Advanced Materials Bipropellant Rocket (AMBR) engine, a 150-lbf rhenium-iridium chamber produced by Plasma Processes, Inc. (PPI) and Aerojet, recently set a hydrazine specific impulse record of 333.5 seconds. To withstand the high loads during terrestrial launch, rhenium chambers with improved mechanical properties are needed, i.e., 40ksi yield strength and 10% elongation at room temperature. Recent electrochemical forming (EL-Form) work has shown considerable promise for improving the mechanical properties of rhenium by producing a multi-layered deposit comprised of a tailored microstructure, i.e., Engineered Re. In addition, the multi-component processing ability of the EL-Form process has the potential to significantly reduce the cost of producing advanced rhenium-iridium thrust chambers. Therefore, PPI and its industry partner, Aerojet, will work together to develop rhenium based in-space engines with improved mechanical properties at a reduced cost.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Primary U.S. Work Locations

Alabama

Ohio

Project Transitions

**February 2011:** Project Start**September 2011:** Closed out

Closeout Summary: Improved Rhenium Thrust Chambers for In-Space Propulsion, Phase I Project Image Improved Rhenium Thrust Chambers for In-Space Propulsion, Phase I

Closeout Documentation:

- Final Summary Chart Image(<https://techport.nasa.gov/file/140211>)

Project Management

Program Director:

Jason L Kessler

Program Manager:

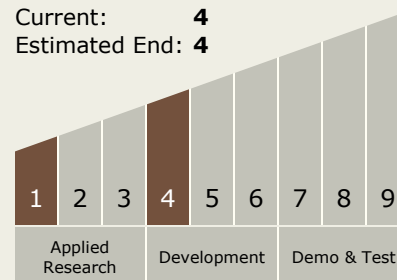
Carlos Torrez

Principal Investigator:

John O'dell

Technology Maturity (TRL)

Start: **1**
 Current: **4**
 Estimated End: **4**



Technology Areas

Primary:

- TX01 Propulsion Systems
 - TX01.2 Electric Space Propulsion
 - TX01.2.1 Integrated Systems and Ancillary Technologies

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System